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Abstract of Thesis Entitled  
**DOES INCREASED PILOT TRAINING COMMITMENT GROUND HIGH-FLYERS?**

Author: Justin Lee Ramey, 2Lt, USAF

2001

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Master of Arts

University of Florida

This thesis explores the effects of changing the length of service owed to the Air Force for attending pilot training. The Air Force demands service as repayment for the expense incurred by the government to provide the training. From time to time, the length of commitment required has altered as the needs of the Air Force have changed. The Air Force believes that increasing the length of commitment will help to address long-term pilot supply issues. This thesis takes an empirical look at one possible negative side effect of increasing the length of commitment owed, namely the possibility of varying effects on the probability of attending pilot training on individuals of different ability levels, demographic make-ups, information positions, and macroeconomic conditions. The group used for studying these issues is a collection of graduates from the United States Air Force Academy from the class years of 1985 through 2000. Using this dataset, which has a plethora of performance and demographic data, a linear probability model is estimated to determine the effect on the probability of selecting pilot training due to an increased commitment length. The results of this study show that increasing the length of commitment leads to a negative impact on the probability of attending pilot training for nearly all of the members of the dataset. Furthermore, the effects are stronger

on the individuals with higher performance, as measured by several different measures used by the Air Force Academy. In multiple interaction models, the negative effects are stronger on individuals showing improvement in performance versus individuals with declining performance. There are no differences in the effects on groups with different demographics and information positions. Additionally, the macroeconomic conditions have small bearings on the results.

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## BIOGRAPHICAL SKETCH

I was born in Minneapolis, Minnesota, in 1978. My family moved around during the early years of my life, living in Boise, Idaho, and Knoxville, Tennessee, before settling in Pittsburgh, Pennsylvania. I lived there for all of my schooling through my sophomore year of high school. At this point, I moved to Oviedo, Florida, where I graduated from high school. Upon graduation, I enrolled at the United States Air Force Academy in Colorado Springs, Colorado. I graduated with a Bachelor of Science degree in aeronautical engineering and economics as well as a commission as a 2<sup>nd</sup> Lieutenant in the Air Force in May of 2000. I entered the Master of Arts program in the Department of Economics at the University of Florida in August of 2000.

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DOES INCREASED PILOT TRAINING COMMITMENT GROUND HIGH-FLYERS?

By

JUSTIN LEE RAMEY

A THESIS PRESENTED TO THE GRADUATE SCHOOL  
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR THE DEGREE OF  
MASTER OF ARTS

UNIVERSITY OF FLORIDA

2001

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Abstract of Thesis Presented to the Graduate School  
of the University of Florida in Partial Fulfillment of the  
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By

Justin Lee Ramey

August 2001

Chairman: David N. Figlio  
Major Department: Economics

This thesis explores the effects of changing the length of service owed to the Air Force for attending pilot training. The Air Force demands service as repayment for the expense incurred by the government to provide the training. From time to time, the length of commitment required has altered as the needs of the Air Force have changed. The Air Force believes that increasing the length of commitment will help to address long-term pilot supply issues. This thesis takes an empirical look at one possible negative side effect of increasing the length of commitment owed, namely the possibility of varying effects on the probability of attending pilot training on individuals of different ability levels, demographic make-ups, information positions, and macroeconomic conditions. The group used for studying these issues is a collection of graduates from the United States Air Force Academy from the class years of 1985 through 2000. Using this dataset, which has a plethora of performance and demographic data, a linear probability model is estimated to determine the effect on the probability of selecting pilot training

due to an increased commitment length. The results of this study show that increasing the length of commitment leads to a negative impact on the probability of attending pilot training for nearly all of the members of the dataset. Furthermore, the effects are stronger on the individuals with higher performance, as measured by several different measures used by the Air Force Academy. In multiple interaction models, the negative effects are stronger on individuals showing improvement in performance versus individuals with declining performance. There are no differences in the effects on groups with different demographics and information positions. Additionally, the macroeconomic conditions have small bearings on the results.

## INTRODUCTION

In the fall of 1998, the Air Force announced that the length of the service commitment owed for the completion of pilot training was being increased to ten years, effective October 1, 1999. According to General Michael Ryan, Air Force Chief of Staff, this change was made to “ensure we meet our Air Force pilot needs in the future” (“Active Duty”, 1998). The Air Force’s goal is to get more of a return, in the form of additional service time, on its considerable investment in its pilots.

Training members of the military for specific jobs can be extremely costly due to the highly technical nature of the training required to gain proficiency in many military jobs. This is particularly true in the case of training pilots for the U.S. Air Force. The average investment in a pilot over the first nine years of service is \$5.9 million (“Active Duty”, 1998). This money is not spent without receiving something in exchange from those who get the training. Depending on the type of training received, service members agree to serve a length of time in the military to “pay” the government back for the expense of the training. This commitment to serve is known as the Active Duty Service Commitment, or ADSC. As mentioned above, the ADSC for the completion of pilot training is currently ten years.

This commitment length has varied over time based on the manpower needs of the Air Force. The 10-year commitment took effect on October 1, 1999, and applies to all officers commissioned in 2000 and beyond (“Active Duty”, 1998). During the period of 1988 until 1999, the commitment for pilot training was 8 years. The commitment

during 1987 was 7 years. Prior to 1987, only 6 years of active duty was required to pay back the Air Force (Duffet, 2001). The stated purpose for the most recent change was to create a long-term solution to the current pilot shortage, caused by low retention rates and limited training capacity. The Air Force leadership felt that the increase in the length of ADSC for pilot training would help to alleviate this shortage.

While the Air Force apparently believes the policy change would lead to an improvement in the state of the pilot force, this may not necessarily be the case. The potential exists for negative impacts on individuals' decisions to attend pilot training caused by this policy change. Two possible such impacts might be caused by the policy. First, the number of pilots electing to attend pilot training might decline as the opportunity cost of pilot training has increased. Second, the policy change could also affect the quality of those candidates who elect to go to pilot training. If the increase in opportunity cost causes a change in behavior, it will do so in those candidates who have the most potential to earn more elsewhere. There exists the possibility that this could reduce the overall quality of the pilot corps by encouraging the best candidates to alter their career-path selection.

This thesis focuses on the second issue described above, namely the issue regarding the quality of those candidates who elect to attend pilot training. The overall goal of this study is to determine if the policy has any negative impacts on the quality of the candidates who attend pilot training. A variety of data is collected and analyzed to determine the effect that the length of time owed for pilot training has on the decision to enter pilot training. Additionally, the data is studied to see if the impact of the policy varies with the quality of the potential candidate.

This thesis first describes the system for becoming a pilot in the Air Force. The data is discussed, elaborating on both the sources and the meaning of the data elements. After this, the model used to analyze the data is explained and the results from this model are detailed. The thesis then describes several alternate studies done to confirm the validity of some of the procedures used. Potential points of contention with the study are raised and discussed in the following section. The thesis then concludes with a final discussion of the meaning of the results and some recommendations based on these results.

## PILOT TRAINING IN THE AIR FORCE

Before discussing the method of analysis used to determine the impact of the policy, it is worthwhile to explain the methods of getting to pilot training in the Air Force. To become a pilot in the Air Force, a person must first receive a commission as an officer. There are three different pathways for obtaining a commission and becoming a potential pilot candidate. These three commissioning sources are Reserve Officer Training Corps, Officer Training School, and the Air Force Academy. Each source is different from the others, but all yield the same end result of a commission in the Air Force.

Reserve Officer Training Corps (ROTC)<sup>1</sup> is a geographically diverse program, with detachments at civilian universities throughout the country. Air Force ROTC is a program designed to commission officers while they complete their college degrees. While enrolled in ROTC, an individual receives military training and attends a civilian college at the same time. Cadets enrolled in ROTC can also qualify for scholarships to cover the costs of tuition. The program can last anywhere from one to four years, depending on the needs of the Air Force for personnel. During each year, cadets take classes that teach basic Air Force knowledge and professional officer skills. During one summer of the program, cadets attend a four- to six-week field-training course, where

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<sup>1</sup> Information on ROTC is taken from the ROTC website, <http://afoats.maxwell.af.mil/rotc.htm>, and from the University of Florida Air Force ROTC website, [www.afrotc.ufl.edu](http://www.afrotc.ufl.edu).

they receive weapons training and survival training, among other things. Upon the completion of the ROTC program, cadets receive a commission in the Air Force as a second lieutenant.

Officer Training School (OTS)<sup>2</sup> is a twelve-week course to commission officers into the Air Force. It consists of classroom work, lectures, and exercises designed to build leadership and develop the skills needed by an officer. It is only open to college graduates under the age of 35. Upon completion of the program, graduates are commissioned into the Air Force.

The United States Air Force Academy (USAFA) is a four-year institution where cadets earn a Bachelor of Science degree in addition to a commission in the Air Force. The Air Force Academy differs from ROTC in that it is a military university with a large portion of the faculty being officers. ROTC is a class at a regular university where the only instructors who are officers are those teaching the ROTC program.

The three commissioning programs are similar in that they all teach the same basics of officership and Air Force knowledge. Graduates of any of the three programs receive a commission into the Air Force upon completion of the program. The primary differences are in the location of training and the point in a person's life at which he or she enters the training. Once the commission is received, there is no difference due to the source of the commission; a lieutenant is a lieutenant, regardless of the commissioning source.

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<sup>2</sup> Information on OTS is taken from the Air Force OTS website, <http://ots.maxwell.af.mil/>.

Just prior to the completion of the commissioning program, the cadets undergo a process to determine which career field they will enter in the Air Force. For reasons that will be explained later, this thesis examines data on graduates from USAFA only. Because of this selection of a limited pool of candidates for study, only the process of selecting a career field for USAFA cadets will be explained.

Before being admitted to the Academy, candidates must undergo a fairly rigorous medical examination to determine their medical status for service. This is the first step in becoming a pilot, as even stricter medical standards are required of pilots than of non-flying officers.

While at the Academy, cadets are evaluated in many different areas, including academic performance in a set of core classes common to all cadets, academic performance within the cadets' selected majors, military performance, and athletic performance. Each of these areas is used in determining the cadet's rank, or order of merit, in the class.

Midway through the junior year of the Academy, cadets undergo another round of medical screenings to determine their final medical status at graduation. At the beginning of the senior year, cadets fill out a listing of the Air Force jobs, known as Air Force Specialty Codes or AFSCs, which they would like to have after graduation. First, cadets who are medically qualified are asked if they want to fly. Then, all cadets, including those who want to fly, are required to list their top five non-flying jobs. At the beginning of the final semester at the Academy, cadets finally pick their actual jobs. First, cadets are split into two groups: those seeking pilot assignments and those not seeking pilot assignments. The selection then goes by the order of merit. The first person in the order

of merit for pilot-qualified cadets selects the pilot slot that that person desires. The selection continues in order of merit until all of the pilot slots are gone or until all who are qualified for one and want one have selected one. The remaining people fall into the category of those who did not want a pilot slot, were not medically qualified for a pilot slot, or did not have the opportunity to pick one because all available slots were taken. These cadets then pick the non-flying jobs in a similar fashion to the process of picking pilot slots. Upon graduation, the newly commissioned lieutenants move on to their new jobs for a minimum of 5 years, the ADSC for the Academy education, unless their job requires additional training, and thus an additional ADSC, such as the ten-year commitment for pilot training.

## DATA

As mentioned above, only data from USAFA cadets are used in this study. There are several reasons for using data from this source only. First of all, while USAFA graduates account for only 19.5% of commissioned officers in the Air Force, they represent 44.4% of pilots. This makes USAFA the single largest source of pilots for the Air Force. The next largest source of pilots is ROTC, providing 42.9% of current pilots (Air Force Personnel Center, 2001). However, since the ROTC detachments are at different universities spread across the country with little interaction between detachments, it is hard to view ROTC as a single source where each officer receives as similar an experience as all Academy graduates share. While the core of the experience and requirements for the ROTC program are the same, the individual culture and college experiences differ with each university. Each individual ROTC detachment provides only a small portion of the pilots for the Air Force. In contrast, USAFA provides a source of common experience that can eliminate many other unobserved effects in the study.

In addition to being the largest single source of pilots for the Air Force, USAFA presents several other advantages for research. Unlike OTS, it is a four-year program, which provides more opportunity for assessment of the cadets before they make their decision regarding their Air Force job. Additionally, USAFA collects and maintains a wide variety of data on its students' pre-college preparation and performance at the

Academy, providing an easy source for uniform and viable data. A more robust study would attempt to integrate data from the other commissioning sources into the study.

For this study, a model is constructed to determine the impact of the policy regarding commitment length. Before explaining the model used, the covariates used to create the model and the sources of these covariates are described.

The principal source of data for this study is the database of information on graduates of USAFA maintained by the Office of Institutional Research and Assessment (XPR). XPR is the office in charge of research for USAFA. Its job is providing “studies and analysis services for policy and decision making, coordinating assessment efforts across Academy organizations, managing institutional databases, and providing statistical data for internal and external customers” (Office of Institutional Research and Assessment website, 2001). XPR maintains data on a cadet’s demographics, performance, and discipline history, among other things. All out-processing and graduating cadets complete several surveys, with the results of those surveys being incorporated into the database. XPR’s database provides the largest source of demographic and performance data on individual graduates. In order to obtain information on post-USAFA career choices, these data are merged with a file from the Air Force Personnel Center, which provides information on the status of graduates of USAFA regarding pilot training.

Some of the covariates used are fairly common data elements and will not be explained in detail. These elements include race,<sup>1</sup> sex, the state of residence prior to

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<sup>1</sup> The only categories for race are Native American, Asian/Pacific Islander, Black, Hispanic, White, and Other. Dummy variables are created to allow each cadet to be classified in one of these racial categories.

entering USAFA, the academic major at USAFA, SAT math and verbal scores, SAT2 scores, and ACT math, verbal, science, and reading scores. Other covariates are more specific to the Academy situation or have some unique properties and thus warrant some explanation. These covariates include data to determine admission to the Academy, performance data while at the Academy, and data regarding the parental military status, medical status and graduation status of the cadet. Table 1 presents some summary statistics on the numerical data.

Table 1. Summary Statistics on Numerical Data.

| Variable                               | Observations | Mean     | Standard Deviation |
|--|--------------|----------|--------------------|
| SAT Math                               | 4405         | 662.8218 | 56.26351           |
| SAT Verbal                             | 4405         | 577.1305 | 62.85829           |
| ACT Math                               | 3892         | 29.77569 | 3.186613           |
| ACT Verbal                             | 3892         | 25.57734 | 3.193081           |
| SAT2 Reading                           | 330          | 533.4242 | 78.50872           |
| SAT2 Science                           | 331          | 676.5559 | 67.72211           |
| ACT Reading                            | 3892         | 27.89106 | 3.922594           |
| ACT Science                            | 3892         | 30.16675 | 2.917295           |
| Weighted Composite                     | 8297         | 614.9311 | 40.81145           |
| Academic Composite                     | 8297         | 3179.749 | 261.8226           |
| Graduation Order of Merit <sup>a</sup> | 8297         | 50.56854 | 28.44962           |
| Academic Order of Merit <sup>a</sup>   | 8297         | 50.0915  | 28.61418           |
| Military Order of Merit <sup>a</sup>   | 8297         | 51.12521 | 29.287             |
| Athletic Order of Merit <sup>a</sup>   | 996          | 50.04568 | 29.11667           |
| Core GPA                               | 8297         | 2.851132 | 0.4518131          |
| Cumulative GPA                         | 8297         | 2.878256 | 0.4490465          |
| PE GPA                                 | 8297         | 3.119534 | 0.4076689          |
| # of times on Superintendent's List    | 8297         | 1.456912 | 2.096481           |

Notes: <sup>a</sup> The orders of merit are normalized to be percentage rankings in the class.

The first group of covariates consists of data elements used by USAFA to determine admission. Two elements fall into this category, the academic composite score and the weighted composite score. The academic composite score is a numerical

measure of the academic qualifications of each applicant. It is designed to allow for comparison among candidates who are from different high school environments. It is a combination of the high school record and SAT or ACT scores, with some weighting factors that reflect the Academy's desired areas of emphasis. The academic composite has a range from 0 to 4000. The minimum academic composite for admission is 2700<sup>2</sup> with an average score of 3190.

The weighted composite score is similar to the academic composite score. It is a numerical measure of the overall qualifications of the applicant. The weighted composite is a combination of the academic composite and the extracurricular composite.<sup>3</sup> The weighted composite is designed so that a higher score corresponds to higher potential in an applicant and is used in the decision to admit specific members of a class. While not the sole factor in the admission decision, it is a significant factor and can be viewed as representing the Academy's assessment of the applicant's ability to succeed as a cadet. The range on the weighted composite is 0 to 800 with 540 being the minimum<sup>4</sup> for admission and 620 being the average score of admitted cadets.

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<sup>2</sup> Although the minimum academic composite is listed as 2700, there are people admitted to the Academy with scores below this level. The 2700 benchmark is not a rigid one, and can be waived for candidates with other desirable characteristics. In the primary pool used in this study, 174 out of 8,297 observations (2.1%) are below this level.

<sup>3</sup> The extracurricular composite is a measure of athletic and non-athletic activities, including things such as varsity letters, club positions, and other activities. This composite is not used by itself in this study.

<sup>4</sup> Similar to the minimum requirement on the academic composite, this requirement is not rigid and some of the people admitted to the Academy have a score below this requirement. In the primary pool used in this study, 213 out of 8,297 observations (2.6%) are below this level.

The next group is the group of covariates that measure the performance of the individual while at the Academy. These covariates include the graduation, academic, military, and athletic orders of merit, the core GPA, the cumulative GPA, the physical education GPA, the military performance average, and the number of times on the Superintendent's list.

The various orders of merit represent that individual's standing in his or her class in that area at the time of graduation. The military order of merit is based on a rank ordering of the military performance average; likewise, the academic order of merit is based on a rank ordering of the cumulative GPA. The athletic order of merit<sup>5</sup> comes from a weighting of several components, specifically the physical education GPA and performance on physical fitness tests.<sup>6</sup> The graduation order of merit is a weighted score of performance in all three areas, academics, athletics, and military. The graduation order of merit is used to determine who graduates as a distinguished graduate and also as an ordering for selecting AFSCs upon graduation.

Cumulative GPA is the grade performance in all academic classes. The core GPA is slightly different. There are a large number of core classes that all cadets are required to take, regardless of major. Currently, the core consists of 109 hours of course work, including 49 semester hours of engineering and basic sciences, 45 hours of humanities

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<sup>5</sup> A specific athletic order of merit was not assigned to cadets until 1997. Prior to this, there was no specific ordering of athletic performance, but athletic performance was included in the graduation order of merit.

<sup>6</sup> The fitness tests include a test of aerobic fitness and a test of strength and endurance. Each of the tests is scored on a numerical scale of 0 to 500, based on the performance in each event, and then converted to a GPA-like scale to be combined with the physical education grades.

and social sciences, 7.5 hours of Military Strategic Studies, 6 hours of physical education classes, and 1.5 hours of Air Force Operations (US Air Force Academy Academics Fact Sheet, 2001). The core GPA represents the academic performance in these classes and can be used to compare academic performance in the classes that all cadets have in common. The physical education GPA is a measure of performance in the required physical education classes. Cadets must take three 0.5 credit physical education classes a year and receive a grade based on performance in the class. All three of these measures are on a standard 4.0 scale.

The military performance average (MPA) is a measure of the individual's performance of the required military duties. Cadets hold a variety of positions in the cadet wing, with the level of responsibility correlated with the class year. The senior cadets hold the highest leadership positions, with junior and sophomore cadets serving as staff under the seniors' leadership. The freshmen cadets do not hold a specific position, but rather focus on learning the basics of military service. In addition to specific requirements based on the position a cadet holds, there are duties that all cadets have, such as the proper wear and maintenance of the uniform, maintenance of the dormitories, marching and drill requirements, and knowledge of the military. The MPA is the assessment of the cadet's performance in all of these areas. The assigning of an MPA is done based on the recommendations and evaluations of the cadet's superiors, including officers, instructors, and other cadets in superior positions. The MPA system also operates on a quota system, with limited number of various scores available to be assigned. MPAs are assigned every semester, as well as in the summer for positions held

in military programs. These individual MPAs are averaged to yield the MPA score of a cadet. MPAs are assigned on a 4.0 scale, similar to GPA.

The final measure of performance used in this study is the number of times a cadet appeared on the Superintendent's list. The Superintendent's list is published each semester and recognizes outstanding performance in academics, athletics,<sup>7</sup> and military duties. To appear on the list, a cadet must have a semester GPA over 3.0, a semester MPA over 3.0, and a semester physical education score over 3.0. Appearance on the list signals the ability to do well in all areas at the same time.

The next data elements deal with the military status of the cadet's parents. These elements contain data on both parents and whether they served in the military or not. They tell in which branch of the military the parent served and the status of that service (active, reserves, national guard, retired, separated, or deceased). From this information, several dummy variables regarding the military status of the parent are created. Dummies for any parent in the Air Force, any parent in a military branch other than the Air Force, any parent in any branch of the military, and both parents in the military are created.<sup>8</sup>

Another pair of covariates deals with the medical status of the cadet. The medical status is identified separately for entry and graduation. Before entering USAFA and again before graduating, cadets must undergo an extensive physical examination to determine their medical qualifications for military service. During the exam, all areas of

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<sup>7</sup> The Superintendent's list did not include athletic performance until 1997. Prior to this, it was based only on academic and military performance.

<sup>8</sup> These dummies are not all completely independent from each other. Because of this, not all of them can be included in a single regression without getting multicollinearity.

health are studied, including vision, hearing, height, weight, dental health, the respiratory system, the gastrointestinal system, the musculoskeletal system, the heart and vascular system, and mental health. The results determine in which category the individual belongs. Usually, candidates for admission ruled not qualified will not be admitted to USAFA and USAFA cadets becoming not qualified during their time at the Academy may be medically discharged. Waivers for the medical requirements are available on a case-by-case basis. These waivers may grant cadets a higher level of medical clearance, such as granting commission-qualified cadets pilot qualification or individuals deemed not medically qualified commission-qualified status. Each waiver is a unique decision and no general rule is available for determining when a waiver is granted and when it is not (USAFA Admissions Catalog, 2001). From this information regarding medical status, several dummy variables are created. For the entering medical status, the dummies created represent pilot-qualified, pilot-qualified with a waiver, navigator-qualified, navigator-qualified with a waiver, commission-qualified, not commission-qualified, and unknown medical status. For the graduation medical status, the dummies created are slightly different. Waivered status is no longer relevant. Therefore, the categories are pilot-qualified, navigator-qualified, commission-qualified, disqualified, and medical status not available.<sup>9</sup> Additionally, one more dummy is created for the

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<sup>9</sup> The observations that have medical status at graduation as not available are usually observations where the cadet out-processes from the Academy and thus never graduates.

classification of medically qualified for a specialist field, which is a more rigorous qualification than commission qualified.<sup>10</sup>

The next group of data elements is used to create a set of dummy variables that identify the cadet's graduation status. The categories created by these dummy variables are graduated and entered the Air Force, graduated and entered any branch of the military, including the Air Force, involuntarily separated from the Academy, voluntarily separated from the Academy, and graduated posthumously. The involuntarily separated designation is for those cadets who leave the Academy not of their own volition for offenses such as honor code violations, poor grades, unacceptable athletic performance, poor military performance, and criminal infractions, among other things. Voluntarily separated means that the cadet decided for one reason or another to leave the Academy of his or her own free will and was not forced out for poor performance.<sup>11</sup>

Other data for the study provide information on the decision to attend pilot training following graduation,<sup>12</sup> the length of commitment faced for pilot training, and macroeconomic data on a state level.<sup>13</sup>

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<sup>10</sup> The specialist qualification is for AFSCs such as missileer or Air Traffic Controller that have more rigorous qualifications than the commission qualification, but different requirements than the pilot qualification or the navigator qualification.

<sup>11</sup> This means that voluntarily separated cadets can be viewed as revealing a preference for not serving in the military, while no such conclusion can be drawn about those who are involuntarily separated.

<sup>12</sup> This information is used to create a dummy, which applies only to the decision immediately following graduation. It is possible to enter pilot training after starting in another career field. However, this decision is not considered in this study.

<sup>13</sup> The macroeconomic data, as is explained below, is used in the interaction terms. The source for this data is data collected from county business patterns.

## METHODS OF ANALYSIS

The initial data set gathered for analysis consists of 21,673 observations. These observations represent all the individuals who enrolled at the Air Force Academy from 1981 to 1996, representing the classes of 1985 through 2000. The set is broken into several groups for initial analysis. The groups of study are segmented based on medical and graduation status.<sup>1</sup> During this initial analysis, several different medical and graduation characteristics were considered for inclusion in the final group. The initial analysis will not be described in great detail here, but it consisted of comparing trends in the data between the different groups considered.

The result of this initial analysis is the selection of a group that had several distinct characteristics. First, only those cadets who graduated from the Academy and entered any branch of military service are included.<sup>2</sup> This group represents the part of the overall data set that was eventually faced with the pilot training decision and made an observable choice. While it can be argued that those cadets who voluntarily left the Academy also could be observed to make a choice, these individuals are not included because many times they lack sufficient data for inclusion in the study. For example, a

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<sup>1</sup> The groups studied in this analysis consist of groups consisting of all observations who graduated from the Academy, all observations who graduated from the Academy and are pilot-qualified, all observations who graduated or voluntarily separated, and all observations who graduated or voluntarily separated and are pilot-qualified.

<sup>2</sup> The total number of people who graduate from USAFA and do not enter the Air Force, but enter one of the other branches of military service is 107 out of the 8,297 (1.3%).

cadet who leaves after one semester does not provide sufficient performance data and thus could skew the results. Also, the voluntary separated designation is sometimes misleading as individuals sometimes resign rather than go through the disenrollment process. These individuals are shown to have left on their own, but that may be because they were going to be forced out and did not want to wait around for the disenrollment process to be completed. In subsequent work, the biases associated with making this exclusion will be investigated more fully.

The next characteristic of the final group selected for study is that all members are medically either pilot-qualified at entry or pilot-qualified with a waiver at entry. This excludes any individuals who attend the Academy, but are never physically qualified to select pilot training. Including these people could skew the results because the observed decision would be that these people chose not to attend pilot training; however, they might have chosen to attend, had they been qualified. Since they are not qualified, the decision is made for them.

Once the data is segmented to include only cadets who were medically qualified to attend pilot training at the time of entry into the Academy and then graduated and entered military service, the number of observations decreases to 8,297. From these observations, a basic model is created and analyzed through the use of linear regressions.<sup>3</sup>

The fundamental estimating equation used in this analysis is:

$$\text{Pr(Pilot)} = \alpha + \beta\bar{X} + \gamma(\text{Commitment}) + \phi(\text{trend}) + \theta(\text{pilot control}) + \mu(\text{interactions}) + \varepsilon$$

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<sup>3</sup> Several specifications are also considered on a group that added those cadets who ended up as pilot-qualified at graduation. No significant differences were noted in the results.

where  $\text{Pr}(\text{Pilot})$  represents the probability of selecting pilot training as the initial AFSC upon graduation. This equation is estimated using a linear probability model, rather than a Probit model, because of the desire to compare group means in the analysis. Future work will determine sensitivity to this linearity assumption. Commitment represents the length of commitment in years owed to the Air Force for pilot training. Including the trend variable, which is created from the graduation class year, controls for time trends. The vector  $\bar{X}$  represents a set of individual data based on the information explained in the data section above. Included in this vector are measures of race, sex, weighted composite score, academic composite score, core GPA, cumulative GPA, physical education GPA, MPA, number of times on the Superintendent's list, parental military status, graduation order of merit, academic order of merit, and military order of merit.<sup>4</sup> The pilot control variable is introduced to control for the number of pilot slots available in any given year. Included in the dataset are class years that are after the Cold War. At this period in time, there was a massive reduction in the size of the military and the Air Force Academy was not spared from the effects of this reduction. The primary effect was that, for several years, the number of pilot slots available was much fewer than other years. To control for the variability in the number of pilot slots available, this variable is introduced. The value of the variable for each observation is the number of pilot slots available for the year that corresponds to the observation.<sup>5</sup> The interaction term changes with the

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<sup>4</sup> Athletic order of merit is omitted because it is missing in the majority of the class years.

<sup>5</sup> Another control considered is a dummy variable that separated years that had limited pilot slots from those with a larger allotment. Usually, under the larger allotment, all cadets who desire a pilot slot can get one. This alternate control does not cause the results to differ significantly from those obtained with the control used.

regression run, but in general represents an interaction between a variable of interest and the commitment variable. Two main interaction models are used. The first consists of only interactions between two variables. In this study, the two-way interactions all deal with the commitment length variable and another parameter of interest. The coefficient on the interaction term can be interpreted as the differential effect of the policy change between the various levels or groups of the parameter of interest being interacted with the commitment length variable. The second type of interaction term consists of three-way interactions between variables. In the three-way model, three separate variables are chosen for interaction. One of these variables is always the commitment length variable. The three-way model includes three different two-way interactions representing every possible combination of the three variables. Additionally, there is an interaction term between all three of the variables.

The primary parameters of interest in this study are the coefficient on commitment,  $\gamma$ , which represents the general effect of the change in commitment on the probability of selecting pilot training, and the coefficient on the interaction terms,  $\mu$ , which represents the differing effects of the commitment change on different individuals who have a certain characteristic level of the variable interacted. By combining these coefficients, the effect of the policy change can be evaluated.

The model can be used to identify the effects of the policy regarding commitment length through the use of linear regressions on the dataset. The coefficients from these regressions are interpreted to determine the effects of a change in policy. Once the coefficients are estimated, the variable that was selected for the interaction term is partitioned into levels of interest. For variables of a numerical nature, such as weighted

composite, the levels of interest are the minimum score, the 25<sup>th</sup> percentile score, the median score, the 75<sup>th</sup> percentile score, and the maximum score. For categorical variables, such as gender, the levels of interest correspond to the combinations of dummy variables necessary to allow the comparisons of all the different groups possible. The parameters of interest are then combined with these various levels to determine the effect of the policy on each level of individual.<sup>6</sup> This general analysis is conducted with several different variables used in the interaction term and then the results are interpreted to determine the effects of the policy change.

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<sup>6</sup> For example, in the regression interacting weighted composite with commitment length, multiplying the value of the maximum weighted composite by the coefficient on the interaction term and then adding the coefficient of the commitment variable determines the effect of a one year change in commitment on the individual with the highest weighted composite. In equation form:

Effect on max wgt. comp=(max wgt. comp score)\*interaction + commitment coefficient.

## RESULTS

The first set of results deals with a baseline model without interaction terms. As mentioned above, a linear probability model is used rather than a Probit model. This decision is based on the need to compare means in the study. A linear probability model allows for mean comparisons much easier than does a Probit model. However, in order to establish a comparison between the two, a Probit model is run. The model run is a simple one that involves no interaction terms. In addition, a simple linear probability model without interaction terms is built. This allows for two things to be accomplished. First, it allows for the comparison to the Probit Model to demonstrate that there are not drastic differences. Second, it allows for a basic model to be studied without the interaction effects to try to determine the basic effect of the policy change. Table 2 presents the results of these two models.

Studying Table 2, it is seen that there are not strong differences between the Probit model and the linear probability model. As such, the linear probability model is acceptable to use and will be used for the reasons stated above. Secondly, the table shows that there is an overall negative effect due to increasing the length of commitment owed for pilot training. The interpretation of this effect says that a one-year increase in the length of commitment owed for pilot training leads to approximately a 7.7% decrease in the likelihood of attending pilot training.

Table 2. Comparison of Linear Probability and Probit Models.

| Variable                            | Linear Probability Model Coefficient | Probit Model Coefficient |
|-------------------------------------|--------------------------------------|--------------------------|
| Trend                               | 0.0274766                            | 0.0275931                |
| Commitment Length                   | -0.0769777                           | -0.0793533               |
| Gender Dummy                        | 0.2221058                            | 0.2524832                |
| American Indian Dummy               | 0.0632051                            | 0.0623611                |
| Asian Dummy                         | -0.0370822                           | -0.0453034               |
| Black Dummy                         | -0.1136575                           | -0.1286032               |
| Hispanic Dummy                      | -0.056925                            | -0.0638528               |
| Weighted Composite                  | 0.0002901                            | 0.0002981                |
| Academic Composite                  | -0.0000498                           | -0.0000518               |
| Core GPA                            | 0.1359741                            | 0.1450008                |
| Cumulative GPA                      | -0.2779732                           | -0.3154486               |
| PE GPA                              | 0.0460006                            | 0.0507736                |
| MPA                                 | 0.0761735                            | 0.1042734                |
| # of times on Superintendent's List | -0.0114722                           | -0.0114476               |
| Parent in the Air Force Dummy       | -0.0006294                           | 0.0034722                |
| Parent in Any Military Branch Dummy | 0.0142074                            | 0.0127461                |
| Both Parents in the Military Dummy  | -0.1345751                           | -0.1389518               |
| Graduation Order of Merit           | 0.0032197                            | 0.0033004                |
| Academic Order of Merit             | 0.000468                             | 0.0007829                |
| Military Order of Merit             | 0.0004787                            | 0.0003653                |
| Pilot Slots Constraint              | 0.0013612                            | 0.0013319                |

During the initial study of the data, several variables are identified as being the factors of interest for investigating the link between pilot training and the length of commitment. These variables include weighted composite score, academic composite score, race,<sup>1</sup> gender, parental military service,<sup>2</sup> and graduation order of merit.

<sup>1</sup> While race was identified as being worthy of study, some simplifications were made. Due to the small proportions of all of the minority groups identified, observations were lumped into two categories, namely white and non-white. Of the limited dataset of 8,297 observations, 7,427 (89.5%) were identified as white, 314 (3.8%) were identified as black, 304 (3.7%) were identified as Hispanic, 206 (2.5%) were identified as Asian/Pacific Islander, and 46 (0.6%) were identified as Native American.

<sup>2</sup> Parental military status is simplified to consider only several categories, including parent in the Air Force, parent in another military branch, and parent in any military branch.

Additionally, the effects caused by macroeconomic variations are deemed worthy of study. These variables represent the terms that are considered in the interactions of the model described above.

Weighted composite score, academic composite score, and graduation order of merit are included because they are potential measures of quality. Weighted composite and academic composite are the Academy's measures of quality at entry and predictors of success at the Academy. Weighted composite represents the Academy's assessment of overall quality, while academic composite represents the Academy's assessment of intellectual prowess and performance. The higher the score, the more likely that person will succeed in the eyes of the Academy.<sup>3</sup> Graduation order of merit represents the realization of performance while at the Academy. Since it includes an evaluation of the three primary areas of performance as a cadet, it is a measure of overall performance as a cadet and thus can be seen as a measure of overall aptitude at the Academy. Because the goal of the Academy is to train the best possible officers, this means that the order of merit can be seen as a measure of officer ability and potential. Race and gender are included to see if there could be a shift in the basic demographics of the pilot pool. Parental military status is included to determine if there is some sort of information effect. It is hypothesized that individuals with parents in the military and in the Air Force in particular are better informed about issues such as the quality of life in the military and

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<sup>3</sup> As described above, the composite scores are intended to be predictors of success while at the Academy. A simple regression analysis shows that, on the dataset used in this study, weighted composite explains 20.62% of the variation in graduation order of merit, while academic composite explains 24.19% of the variation in graduation order of merit. Additionally, the academic composite explains 26.39% of the variation in academic order of merit. As such, these scores are only moderately accurate in their stated purpose.

use this additional information in making their decision. State macroeconomic variables are included to determine if there is an effect due to differences in local economic conditions.

The first set of model specifications deals with the performance measures discussed above. In these first regressions, only two-way interaction terms are included in the model. Table 3 presents the results of these regressions. Specification 1 interacts weighted composite with the commitment length. In this regression, the coefficient of the length of commitment is positive and significant.<sup>4</sup> This would seem to suggest that increasing the length of commitment for pilot training by one year would increase the likelihood of choosing pilot training by 33.75%. However, this interpretation does not account for the full effects in the model specification. The derivative that measures the full effect is the linear combination of all of the coefficients based on the commitment length variable. This means the interaction term must be accounted for as well as the coefficient on the commitment length variable. Incorporating the interaction term, which is negative and significant, alters the interpretation of the effect of a change in the policy regarding the length of commitment for pilot training. Considering the effects on the various levels of weighted composite shows the true effect of a policy change. The effect on the minimum level of weighted composite observed is positive, but insignificant.<sup>5</sup> At all of the other levels considered in the table, the effect is negative and significant.

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<sup>4</sup> Significance is based on a 10% level of significance. This level will be applied throughout the following discussion. All P-values discussed are based on two-tailed tests.

<sup>5</sup> The effect on the Academy's declared minimum weighted composite score of 540 is also insignificant (P-Value=0.167), but negative (-2.55%).

Looking at the entire dataset, only 11 (0.13%) of the observations have weighted composites that give an overall positive effect and 8,014 (96.59%) of the observations have weighted composite scores that lead to a negative and significant effect due to a policy change.

Table 3. Performance Specifications.

| Dependent Variable: Pr (Pilot Training)        |            |            |            |
|--|------------|------------|------------|
| Specification                                  | 1          | 2          | 3          |
| Commitment                                     | 0.3375004  | 0.1775598  | -0.0303993 |
|  | 0.010      | 0.094      | 0.089      |
| Commitment x<br>Wgt Composite                  | -0.0006723 |            |            |
|  | 0.002      |            |            |
| Commitment x<br>Ac Composite                   |            | -0.0000799 |            |
|  |            | 0.094      |            |
| Commitment x<br>Order of Merit<br>(percentile) |            |            | -0.0009791 |
|  |            |            | 0.001      |
| Minimum  | 0.0146011  | 0.038605   | -0.030491  |
|  | 0.486      | 0.793      | 0.088      |
| 25th Percentile<br>of Variable                 | -0.0572663 | -0.0615382 | -0.0562328 |
|  | 0.000      | 0.000      | 0.000      |
| 50th Percentile<br>of Variable                 | -0.0754853 | -0.0758329 | -0.0801737 |
|  | 0.000      | 0.000      | 0.000      |
| 75th Percentile<br>of Variable                 | -0.0937715 | -0.0904472 | -0.1037283 |
|  | 0.000      | 0.000      | 0.000      |
| Maximum  | -0.1692693 | -0.1426750 | -0.1283102 |
|  | 0.000      | 0.000      | 0.000      |

Note: Each Column represents a separate regression. Coefficients are listed on top with P-values below.

This means the policy change causes a negative impact on the decision to attend pilot training for nearly all cadets. The effect varies with the level of the weighted composite score and this variation is significant, as shown by the significance of the interaction term in Specification 1. The effect becomes more negative with higher weighted composite scores. In summary, increasing the length of the commitment owed

for pilot training will cause an individual to be less likely to elect to go to pilot training, and this effect becomes more pronounced as the cadet's ability, as measured by weighted composite, improves.

Specification 2 interacts the academic composite score with the commitment length variable. Like Specification 1, the coefficient on the length of commitment is positive and significant, but the interaction coefficient balances out this positive effect. The effect on the minimum academic composite score in the dataset is positive, but insignificant.<sup>6</sup> At all of the other levels presented in the table, the effect of a one-year change in policy is negative and significant. In the entire dataset, 2 (0.02%) of the observations have academic composite scores that show a positive effect and 8,208 (98.93%) of the observations have academic composite scores that lead to a negative and significant effect due to the policy change.

Like Specification 1, the results of Specification 2 show a negative impact due to the increased length of commitment. The effect varies with the academic composite score, becoming more negative with higher academic composite scores. The variation in effect due to the level of the academic composite score is significant, as shown by the significance of the interaction term.

The graduation order of merit interacts with the commitment length in Specification 3. In this regression, the coefficient of the commitment length variable is negative and significant. Additionally, the coefficient on the interaction term is negative and significant. This leads to an overall negative impact of the policy change on the

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<sup>6</sup> The effect on the Academy's declared minimum academic composite score of 2700 is negative (-3.81%) and significant (P-value=0.040).

decision to attend pilot training. This impact is observed at all the possible levels of graduation order of merit. Specification 3 shows similar results to Specifications 1 and 2. There is a negative impact associated with increasing the length of commitment owed for pilot training. This effect changes with the order of merit at graduation. Those individuals who graduate higher in the class respond more than their lower-ranked classmates. Since the coefficient on the interaction term is significant, the variation in impact is significant.

An interesting question regards the exact size of the magnitude of the effects observed. Because 69.54% of those cadets in the top third of weighted composite score attend pilot training, this can be viewed as the probability of an individual in the top third attending pilot training. The observed effect of shift in policy on the individual with the 75th percentile value of weighted composite is -9.38%. This means that the policy change causes a 13.48% decrease in the likelihood of attending pilot training. For the median individual, the policy change reduces the likelihood of going to pilot training by 7.55%. The overall likelihood of attending pilot training for the middle third is 71.71%. This means that the policy change causes a 10.53% decrease in the likelihood of attending pilot training. The policy reduces the likelihood of the individual with the 25th percentile score attending pilot training by 5.73%, while the overall likelihood of attending pilot training for an individual in the bottom third of weighted composite is 72.86%. This means that the policy change causes a 7.86% decrease in the likelihood of attending pilot training.

Likewise, the magnitude of the impact must be considered on the specification regarding academic composite score. Because 71.06% of those cadets in the top third of

academic composite score attend pilot training, this can be viewed as the probability of an individual in the top third attending pilot training. The observed effect of shift in policy on the individual with the 75th percentile value of academic composite is -9.04%. This means that the policy change causes a 12.73% decrease in the likelihood of attending pilot training. For the median individual, the policy change reduces the likelihood of going to pilot training by 7.58%. The overall likelihood of attending pilot training for the middle third is 71.89%. This means that the policy change causes a 10.55% decrease in the likelihood of attending pilot training. The policy reduces the likelihood of the individual with the 25th percentile score attending pilot training by 6.15%, while the overall likelihood of attending pilot training for an individual in the bottom third of academic composite is 71.11%. This means that the policy change causes an 8.65% decrease in the likelihood of attending pilot training.

Similarly, the magnitude of the impact must be considered on the specification regarding graduation order of merit. Because 76.81% of those cadets in the top third of graduation order of merit attend pilot training, this can be viewed as the probability of an individual in the top third attending pilot training. The observed effect of shift in policy on the individual with the 75th percentile value of order of merit is -10.37%. This means that the policy change causes a 13.50% decrease in the likelihood of attending pilot training. For the median individual, the policy change reduces the likelihood of going to pilot training by 8.02%. The overall likelihood of attending pilot training for the middle third is 72.46%. This means that the policy change causes an 11.06% decrease in the likelihood of attending pilot training. The policy reduces the likelihood of the individual with the 25th percentile score attending pilot training by 5.62%, while the overall

likelihood of attending pilot training for an individual in the bottom third of order of merit is 64.62%. This means that the policy change causes an 8.70% decrease in the likelihood of attending pilot training.

The negative impact of the policy change observed in Specifications 1, 2, and 3 seems logical. The increased commitment length increases the opportunity cost of attending pilot training. As pilot training becomes more “expensive” to attend, the likelihood of attending will decrease. What is more interesting in these specifications is the interaction effect observed in each regression. Not only is there a negative effect of increasing the commitment length, the effect is stronger on the individuals with higher weighted composite scores, academic composite scores, and graduation orders of merit. Since these scores can be viewed as measures of quality of the individual, the implication is that the policy change is decreasing the quality of the pool of individuals who select to attend pilot training.

Table 4 presents the results from the next group of regressions. These specifications deal with the demographics of the pilot pool and the informational effects due to a parent serving in the military. Specification 4 looks at the interaction between the racial category and the commitment length. The coefficients on the commitment length and the interaction variable are negative, but not significant. This leads to the effect on nonwhites being negative, but not significant, while the effect on whites is negative and significant. Since the interaction coefficient is not significant, the different impacts on the two groups are not statistically significantly different from each other.

Specification 5 interacts gender with the commitment length. In this regression, the coefficient on the commitment length is negative and significant, while the interaction

term is negative but insignificant. The effect on males is negative and significant, as is the effect on females. However, the two effects are not significantly different from each other, since the coefficient on the interaction variable is insignificant.

Table 4. Demographic and Informational Specifications.

| Dependent Variable: Pr (Pilot Training)      |                |                |                |                |                |                |
|--|----------------|----------------|----------------|----------------|----------------|----------------|
| Specification                                | 4 <sup>a</sup> | 5 <sup>b</sup> | 6 <sup>c</sup> | 7 <sup>c</sup> | 8 <sup>c</sup> | 9 <sup>d</sup> |
|  | -0.0369090     | -0.0935967     | -0.0812594     | -0.07676       | -0.0838194     | -0.0839156     |
| Commitment                                   | 0.174          | 0.003          | 0.000          | 0.000          | 0.000          | 0.000          |
| Commitment x Race                            | -0.0447087     |                |                |                |                |                |
|  | 0.114          |                |                |                |                |                |
| Commitment x Gender                          |                | 0.01802        |                |                |                |                |
|  |                | 0.579          |                |                |                |                |
| Commitment x Parent in the Air Force         |                |                | 0.0247067      |                |                | 0.0178063      |
|  |                |                | 0.281          |                |                | 0.566          |
| Commitment x Parent in the Military (Non AF) |                |                |                | -0.0083729     |                |                |
|  |                |                |                | 0.721          |                |                |
| Commitment x Parent in Any Branch            |                |                |                |                | 0.0214498      | 0.0097938      |
|  |                |                |                |                | 0.253          | 0.704          |
|  | -0.0369090     | -0.0935967     | -0.0812594     | -0.0767600     | -0.0838194     | -0.0839156     |
| Group 1                                      | 0.174          | 0.003          | 0.000          | 0.000          | 0.000          | 0.000          |
|  | -0.0816177     | -0.0755767     | -0.0565526     | -0.0851330     | -0.0623696     | -0.0661093     |
| Group 2                                      | 0.000          | 0.000          | 0.008          | 0.000          | 0.000          | 0.048          |
|  |                |                |                |                |                | -0.0563156     |
| Group 3                                      |                |                |                |                |                | 0.008          |

Note: Each column represents a separate regression. Coefficients are listed on top with P-values listed below.

<sup>a</sup>. Group 1 is white. Group 2 is non-white

<sup>b</sup>. Group 1 is male. Group 2 is female.

<sup>c</sup>. Group 1 is no military affiliation. Group 2 is specified military affiliation.

<sup>d</sup>. Group 1 is no military affiliation. Group 2 is Air Force only. Group 3 is any military affiliation.

Specifications 4 and 5 both show some negative effect due to increasing the commitment length for pilot training. In each case, there is not a statistically significant difference between the groups. It appears that the Air Force's decision to alter the length

of commitment owed for pilot training does not impact any specific racial group more than another. Nor does the policy change impact one gender more than the other. This means that the policy change does not appear to significantly alter the demographic makeup of the pilot pool.

Specifications 6, 7, 8, and 9 study parental military status. Specification 6 interacts the dummy for a parent in the Air Force with the commitment length variable. In this regression, the coefficient on the commitment variable is negative and significant. The interaction variable coefficient limits the effect, as it is positive, but it is statistically insignificant. The dummy for a parent in a branch of the military other than the Air Force interacts with the commitment length variable in Specification 7. The coefficient on the commitment length is negative and significant while the coefficient on the interaction variable is negative and insignificant. In Specification 8, the commitment length is interacted with the dummy for a parent in any branch of the military. In this case, the coefficient on the commitment variable is negative and significant, but the interaction coefficient is positive and insignificant.

Specifications 6, 7, and 8 all show the negative impact of increasing the commitment required for pilot training. Since the coefficients on the interaction terms are always insignificant, there is not a statistically significant difference due to having a parent with military service.

The variation in signs on the interaction terms in Specifications 6 and 7 motivate a further regression, which is Specification 9. In this regression, dummies for both a parent in the Air Force and a parent in any military branch are included. Each of these dummies interacts with the commitment variable. In this regression, the coefficient on the

commitment variable is once again negative and significant. The coefficients on the two interaction terms are positive but insignificant. This regression allows study of three categories of people, namely those without a parent in the military, those with a parent in the Air Force, and those with a parent in any branch of the military, including the Air Force. Since the coefficients on the interaction terms are insignificant, there is not a statistically different effect of the policy change on the members of these three groups.

Like Specifications 4 and 5, Specifications 6, 7, 8, and 9 show that the policy change has a negative effect on the decision to attend pilot training, but there is no statistically significant difference in the possible groupings. This means that there is no strong difference in the pilot training decision given an informational advantage of familiarity with military service.

Table 5 presents the results for several three-way interaction regressions. Specification 10 focuses on the effects of the weighted composite score and graduation order of merit simultaneously. This regression is conducted to allow a study of the different effects on the two general measures of quality. There is some correlation between graduation order of merit and the weighted composite score, but it is not perfect correlation. This interaction regression allows for a study of different relevant positions for both measures. In this regression, the coefficients are mostly insignificant. The only significant coefficient is the one of the three-way interaction variable.

The more interesting results of this specification come from looking at the effects on the various levels of the two measures. The weighted composite score is the Academy's predictor of an individual's chances of success while at the Academy. The order of merit represents the Academy's assessment of the realization of success while at

the Academy. Combining these two measures allows for the study of four types of individuals. These four types are the individual who comes in highly touted and delivers with a high level of performance, the individual who comes in highly touted, but fails to perform up to expectations, the individual who is not predicted to do as well, but exceeds expectations and performs well, and the individual who is not predicted to do as well and performs to these expectations.<sup>7</sup> The strongest negative impact of a policy change is observed on the first individual, namely the one with a high weighted composite score and a high graduation order of merit. The next strongest impact is observed on the third individual, which is the one who comes in with a lower weighted composite score, but graduates with a high order of merit. Following this individual, the individual who enters with a high weighted composite score, but graduates with a lower order of merit, experiences the next strongest effect. The weakest effect is observed on the individual who comes in with a low weighted composite score and leaves with a low graduation order of merit.

These results have an important implication. The effect is stronger on people who improve versus those who decline, which would seem to hurt the Air Force. Someone who performed relatively poorly in high school, earning a low weighted composite score entering the Academy, but then improved, either because he turned around his performance, found his element, or some other similar change, and thus graduated higher

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<sup>7</sup> In considering the cases described here, the strength of the effects also depend on the numbers in each group. In the dataset used for this study, 425 individuals out of 8,297 (5.1%) transitioned from the top third in weighted composite to the bottom third in order of merit. The number transitioning from the bottom third in weighted composite to the top third in order of merit is 406 out of 8,297 (4.9%). Overall, 2,160 individuals (26.0%) transition up at least a third, while 2,128 individuals (25.6%) transition down at least a third. Based on this, the effects observed can be serious.

than his entering performance measurement predicted would seem to be more desirable than someone who came in with a high performance rating, but then failed to back that previous performance and its expectations up while at the Academy. This leads to a question of whether someone on the rise is better than someone who is declining in performance. It would seem logical that the person improving and ending with a better performance would be more desirable than the person who declined and ended with the poorer performance. It can even be questioned whether the declining individual is the least desirable individual of the four described above. The improving performer and the consistently high performer are logically more desirable than the declining performer. It is possible that the consistent relatively low performer is better as well as this individual performs to his expected level. This level of performance is sufficient because this individual still manages to successfully complete the training program of the Academy. The declining performer attained a sufficient level of performance to graduate from the Academy, but might continue to decline to a level where his performance does not meet standards. Because of this, the individual who is consistent could arguably be more desirable than the declining performer.

Specifications 11 and 12 discuss the three-way interactions between performance and the military status of the parents. Since the two-way interactions showed no significant variation in the difference between the different branches of military service, the only category considered here is a parent in any branch of the military. These regressions allow for a comparison between the performance effect and the information effect of having a parent in the military.

Table 5. Three-Way Regressions.

| Dependent Variable: Pr (Pilot Training)                  |            |            |            |
|--|------------|------------|------------|
| Specification  | 10         | 11         | 12         |
|  | 0.0238527  | 0.4083014  | -0.0292472 |
| Commitment   | 0.898      | 0.003      | 0.137      |
| Commitment x Wgt   | -0.0001053 | -0.0007981 |            |
| Composite  | 0.738      | 0.000      |            |
| Commitment x Order<br>of Merit (percentile)              | 0.003      |            | -0.001166  |
|  | 0.165      |            | 0.000      |
| Commitment x Parent<br>in Any Branch                     |            | -0.172517  | 0.0115264  |
|  |            | 0.254      | 0.650      |
| Commitment x Wgt   | -0.0000064 |            |            |
| Composite x Order of<br>Merit                            | 0.089      |            |            |
| Commitment x Wgt   |            | 0.0003189  |            |
| Composite x Parent in<br>Any Branch                      |            | 0.201      |            |
| Commitment x Order<br>of Merit x Parent in<br>Any Branch |            |            | 0.0003156  |
|  |            |            | 0.367      |

Note: Each column represents a separate regression. Coefficients are listed on top with P-values below.

Specification 11 interacts the weighted composite score with the dummy for a parent in any branch of the military. In this regression, the coefficient on the commitment variable is positive and significant. For the two-way interaction variables, both are negative, but only the coefficient of the variable for interaction between commitment length and weighted composite score is significant. The three-way interaction coefficient is positive, but insignificant.

In this regression, the strongest effect is observed on the individual with the highest weighed composite and without a parent with military service. The smallest effect is observed on the individual with the lowest weighted composite and a parent who served in any military branch. The differential effect between having a parent in the military and not having one is larger with higher weighted composite scores. This would

suggest that the informational effect is larger for the individuals with higher weighted composite scores; however the coefficients are not statistically significant. The regression also shows the increasing negative effect on the better caliber individuals.

The interaction between graduation order of merit and the dummy for a parent in the military is considered in Specification 12. In this regression, the only statistically significant coefficient is the coefficient on the two-way interaction between the commitment variable and the graduation order of merit. All other coefficients are insignificant.

The results of Specification 12 are identical to those of Specification 11. The strongest effect is observed on the individual with the highest graduation order of merit and without a parent with military service. The smallest effect is observed on the individual with the lowest order of merit and a parent who served in any military branch. The differential effect between having a parent in the military and not having one is larger with higher orders of merit. This would suggest that the informational effect is larger for the individuals with higher orders of merit; however the coefficients are not statistically significant. The regression also shows the increasing negative effect on the better caliber individuals.

Specifications 13, 14, and 15 consider the effects of the local macroeconomic conditions on the decision to attend pilot training by looking at the unemployment rate in each individual's home state.<sup>8</sup> The results of these regressions are presented in Table 6.

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<sup>8</sup> A regression was also run with the state employment growth rate as the macroeconomic variable used. However, the results did not significantly differ from those obtained using the unemployment rate. The unemployment rate is used and discussed because it is a more common macroeconomic measure.

Specification 13 consists of a two-way interaction between the unemployment rate and the commitment length variable. In this regression, the coefficient on the commitment variable is negative and significant, as is the coefficient on the interaction term. This specification shows the negative impact of increasing the length of commitment. In addition, it shows that the negative effect is stronger on those individuals who come from states with higher unemployment rates. Because the interaction term is significant, the difference in the effect due to different levels of unemployment is significant as well.

Specification 14 consists of a three-way interaction between the unemployment rate, the weighted composite score, and the commitment length variable. In this regression, the coefficient on the commitment variable is positive and significant. The two-way interaction coefficients between commitment length and unemployment rate and commitment length and weighted composite are both negative and significant. This shows that the individual effect on the decision to attend pilot training increases with higher weighted composite scores and unemployment rates. The coefficient on the three-way interaction variable is positive and significant. Thus, this interaction term serves to limit the negative effect on an individual with a set weighted composite score when the unemployment rate facing that individual is increased. Likewise, for a fixed unemployment rate, the effect of the policy change is limited when the weighted composite is increased. The overall impact of a policy change is governed by the combination of all of these factors. In this specification, the strongest effect is seen on the combination of the highest weighted composite score and the highest unemployment rate. Reducing the weighted composite score has more of a mitigating effect than reducing the unemployment rate.

Table 6. Macroeconomic Specifications.

| Dependent Variable: Pr (Pilot Training)         |            |            |            |
|---|------------|------------|------------|
| Specification                                   | 13         | 14         | 15         |
| Commitment                                      | -0.0497727 | 0.5533899  | 0.0424036  |
|   | 0.009      | 0.000      | 0.102      |
| Unemployment Rate                               | 0.0373483  | 0.3897074  | 0.1143457  |
|   | 0.103      | 0.011      | 0.000      |
| Commitment x Unemployment Rate                  | -0.0062606 | -0.0614345 | -0.0191732 |
|   | 0.099      | 0.002      | 0.000      |
| Commitment x Weighted Composite                 |            | -0.0009768 |            |
|   |            | 0.000      |            |
| Commitment x Order of Merit                     |            |            | -0.001796  |
|   |            |            | 0.000      |
| Wgt. Composite x Unemployment Rate              |            | -0.0005751 |            |
|   |            | 0.021      |            |
| Order of Merit x Unemployment Rate              |            |            | -0.0014106 |
|   |            |            | 0.000      |
| Commitment x Wgt Composite x Unemployment Rate  |            | 0.0000903  |            |
|   |            | 0.005      |            |
| Commitment x Order of Merit x Unemployment Rate |            |            | 0.0002421  |
|   |            |            | 0.000      |

Note: Each column represents a separate regression. Coefficients are listed on top, with P-values listed below.

Specification 15 looks at the interaction between unemployment rate, graduation order of merit, and commitment length. In this regression, the coefficient on commitment length is positive, but slightly above the threshold for significance. The two-way interaction coefficients between commitment length and the other two variables are both negative and significant. The coefficient on the three-way interaction variable is positive and significant. This leads to similar results to Specification 14. The strongest effect is seen on the individual with a high graduation order of merit facing a high unemployment rate. Reducing the order of merit limits the effects of the policy change more than reducing the unemployment rate.

Each of the macroeconomic specifications yields some interesting results. The three-way regressions show that the impact is higher on the higher ability individuals. This result has been observed in previous specifications. An interesting result appears when studying the effects on individuals facing the different levels of unemployment. In each specification, a higher unemployment rate leads to a stronger impact on an individual making the pilot training decision. This seems counter to logic as a higher unemployment rate would seem to present fewer job prospects. In a normal situation, the effect would be higher for a lower unemployment rate as increasing the commitment length causes an increase in the opportunity cost. This increased opportunity cost would have a more pronounced effect in low unemployment situations, as the opportunity costs are higher in this situation. However, this is not the effect that is observed. There are several possible reasons for this difference. One possible explanation is that the individuals in the dataset for this study tend to be the more elite graduates from their local high schools. As such, they might feel that they have good job prospects regardless of what the unemployment rate is, as long as it remains within reason, as is the case in the years observed for this study. Thus, they ignore the unemployment rate in their decision. Another issue deals with the timing of the unemployment rate versus the decision timing. This study used the unemployment rate that corresponds to the rate that exists during the year of graduation. However, this rate is unknown at the time of entry to the Academy and by the time it is known, the individual has already incurred some commitment to the Air Force and thus will not be seeking a job in the civilian world for some time. Another possible explanation is that the individuals who are least able to respond to the unemployment rate in the future are impacted by it more. They might respond more now

because of the perceived need to make more money now by getting out of the Air Force sooner because they are lesser ability and more likely to suffer under high unemployment rates. In each of the three-way specifications, the effect of changing the measure of ability leads to a greater change in effect than changing the unemployment rate. This suggests that an individual's abilities play a larger role than the local economic conditions.

## ALTERNATIVE SPECIFICATIONS

In addition to the specifications explained above, several others are generated to look at specific issues. As was explained before, the dataset is limited to those cadets who graduated and entered military service and are pilot-qualified at the time of entry into the Air Force Academy. The reasons for this limitation were explained above. However, the group for analysis is expanded to include all the cadets who graduated and entered the military and were either pilot-qualified at the time of entry or the time of graduation. This group is studied to insure that there are not any strong deviations from the smaller group and thus check the validity of limiting the dataset. The same procedure for analysis as outlined above is conducted on this dataset. The results of the analysis yield similar results as the analysis of the primary group.

Another analysis is conducted using dummies for the different states incorporated into the model. The regressions from this analysis allow the possibility of differential effects of the policy change on residents of different states to be considered. The results of this analysis do not substantially differ from the results of the analysis of the original group. Because of this, it can be concluded that there is not a different effect based on the state from which a cadet comes.

The final set of alternative regressions incorporates the state macroeconomic variables described above into all of the regressions as an additional covariate in the model. Analysis of the results of these regressions shows no substantial differences from the results of the initial analysis. Because of this, the state macroeconomic variables are

not directly incorporated into the model, but are still used in the interaction terms of some specifications.

The results of all of these alternative specifications show that there are not substantial differences from the original model used and thus these issues are not necessary to account for in the study.

## POTENTIAL POINTS OF CONTENTION

There are some points of potential contention with this study. These issues will be addressed here. The first problem is the issue of group selection. This issue is a two-fold issue. The issue of selecting the Air Force Academy, as was explained above, can be potentially troubling. A better study of the issue would look at a larger group including representatives from all commissioning sources. The effects explained in this thesis apply only to the group studied. There could be different effects on pilot candidates who come from other commissioning sources. To make a full evaluation of the policy, these other groups should be considered as well. However, as mentioned above, using only USAFA graduates helps to ensure comparability among the study subjects.

Another issue regarding group selection is the decision to limit the Academy pool further by considering only those cadets who graduate and enter military service and are pilot-qualified at entry. A better study would include all cadets at the Academy. However, the data available is insufficient for such a study. The medical clearance question is difficult to handle. The physical required for graduation is less in-depth than the one required for pilot training. Thus, obtaining a pilot-qualified medical clearance reflects some interest in becoming a pilot. Some people who alter their decision based on the policy change might not have been picked up by this study because they made their decision early and went for the less comprehensive physical.

This leads to another problem, namely the problem of identifying the motivating factors in the decision to attend pilot training. The length of commitment is only one part

that must be considered in making the decision. A better study would conduct interviews of the people making the decision at the time they make it to attempt to weigh the importance of the commitment length, and thus the policy change, in the decision to attend pilot training.

Another area of contention is the interpretation of the weighted composite score, academic composite score, and graduation order of merit as measures of quality. These measures are selected because they are used by the Academy as measures of quality, but they are not perfect. They are subject to extremely complex interactions between a variety of factors and probably do not perfectly measure what they are intended to measure, but they are the best figures available. Additionally, there might not be any correlation between the quality of the pilot and the rank of graduation. However, measuring the quality of the pilot would be extremely difficult because it is subjective and inherently unknown at the time of attendance at USAFA. The measurement error observed in these measures of performance only serves to enhance the results. Measurement error leads towards a bias to zero and an inflation of the standard errors. Both of these serve to reduce the significance of the results observed. If more precise measurements were available, the results would become even stronger statistically.

Another potential sticking point involves the timing of the policy change taking effect, versus its announcement. Usually, the change is not announced until shortly before it takes effect. This means that the people facing the new commitment are already at the Academy and owe the Air Force some service time.<sup>1</sup> Had they had perfect

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<sup>1</sup> There is no direct monetary cost, such as tuition, to attend the Academy. If one stays into his junior year, he will owe the Air Force some amount of service even if he does not graduate. This individual can leave during the first two years without having to pay

information and known the commitment length they would be facing prior to entry or reaching the point of owing the Air Force something for the education received, they might have made a different decision. Since they cannot undo previous decisions, they ignore the change because the additional commitment does not appear as great. The policy change might affect people who are considering attending the Academy. If they alter their decision based on the new commitment length and do not attend the Academy, then they would never enter the dataset and thus the policy change's impact on them would not appear anywhere. It should be noted that this will lead to an understatement of the results found in this thesis. Taking into account people who do not attend USAFA because of the policy change should only strengthen these results.

An additional question deals with the relevance of the state macroeconomic variables. Once a person has graduated from the Academy, the Air Force sends them to where they are needed. If the decision being made is between being a pilot or having some other career in the Air Force, the economic conditions in the home state may not be relevant because the individual will not be returning to the home state. However, if the decision is being made between being a pilot and leaving the Air Force, then the conditions may be relevant.

One might also be concerned about the endogeneity of the interaction terms between cadet qualifications and the policy. The policy change may induce some cadets to work harder to secure some highly competitive non-pilot positions such as medical training. However, there is reason to believe that this concern is not a large one. All of

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anything back. After that, the Air Force demands that he serve time either as an officer after graduating or as an enlisted trooper if he leaves before graduating.

the two-way interactions are re-estimated with all qualifications measures divided into quartiles. The results are found to be substantively and statistically almost unchanged. Therefore, the results herein are not being driven by subtle changes in behavior at the top of the qualification distribution. As an alternative test, the top and bottom 10 percent of the qualification distribution are eliminated. While the precision of the estimates and the magnitudes of the effects fall when this exercise is conducted, the results continue to suggest that the most highly qualified cadets remaining in the sample are less likely to select into pilot training as the service requirement increases.

## CONCLUSIONS AND RECOMMENDATIONS

This thesis shows that the Air Force's shift in policy regarding the length of commitment owed for pilot training has some potentially negative unintended consequences. The increased commitment length has a negative impact on all potential pilots. Furthermore, the policy change has a stronger effect on people who have higher academic and overall performance scores. This means that there is a potential effect of decreasing the quality of the pilots in the Air Force. While the policy change will have its intended effect of addressing the problem of a shrinking pilot force, people with higher performance measures respond to it more, possibly changing their decision regarding becoming pilots. Additionally, it appears that the effect is stronger on those individuals who have shown improvement from the time of entering the Academy to the time of graduation than those individuals who have shown a decline in performance over the same time period. This too would seem to be an undesired side effect, as it appears to dissuade the type of people who would be preferred more than those who might be less desirable. The policy change does not appear to have significantly different effects on different demographic groups of pilots. Also, the local macroeconomic conditions have a questionable effect on the decision to attend pilot training.

These effects, while unintended, might be acceptable to the Air Force. All candidates admitted to the Air Force Academy are highly capable people who have the potential to make fine officers and pilots. The policy change affects only these capable people. If the cadets potentially affected by the policy change were not capable of

becoming quality officers, they would have not been admitted to the Academy. Thus, it can be argued that the effect is perfectly acceptable. After all, it is not the situation that the people becoming pilots now are drastically lower quality than those who became pilots previously. The importance of all the effects identified and discussed in this thesis are somewhat subjective. The fact that they are observed to occur does not show that their impact is extremely detrimental to the Academy or the Air Force. There is no study of the correlation between the quality of a pilot and performance while at the Academy. However, it seems logical to think that, if the Academy is structured properly, there would be some correlation. It is possible that the completion of the Academy program is sufficient demonstration of ability and the actual relative performance at the Academy is not relevant. These are all factors that must be considered in evaluating the overall effect of the policy change.

The point of this thesis is to demonstrate that there is no free lunch, not even for the Air Force. The demonstration of this fact does not mean that the policy should revert to its previous form. That is a decision that must be made by the Air Force. If they value the increased amount of service of pilots in the future due to the longer commitment, then the policy is acceptable. However, if it is deemed that the lowering of quality is unacceptable, than another solution needs to be explored.

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## BIOGRAPHICAL SKETCH

I was born in Minneapolis, Minnesota, in 1978. My family moved around during the early years of my life, living in Boise, Idaho, and Knoxville, Tennessee, before settling in Pittsburgh, Pennsylvania. I lived there for all of my schooling through my sophomore year of high school. At this point, I moved to Oviedo, Florida, where I graduated from high school. Upon graduation, I enrolled at the United States Air Force Academy in Colorado Springs, Colorado. I graduated with a Bachelor of Science degree in aeronautical engineering and economics as well as a commission as a 2<sup>nd</sup> Lieutenant in the Air Force in May of 2000. I entered the Master of Arts program in the Department of Economics at the University of Florida in August of 2000.